XV.—*On the Anatomy of a Collection of Slugs from N.W. Borneo; with a List of the Species recorded from that Region.*

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(Read 3rd June 1901.)

CONTENTS.

I. Introduction.

In the early part of 1900 I received from J. H. Ponsonby, Esq., a small collection of land molluscs from N.W. Borneo, with a request that I would investigate and report upon the same. This collection, the property of the Sarawak Museum, proved, on examination, to contain examples of two new genera (*Wiegmannia* and *Isselentia*) of great interest. In the case of the former genus there were only two specimens, each belonging to a different species; and as more material was very desirable, Mr Ponsonby very kindly invited the authorities of the Museum to send over, if possible, a further collection. This, in due course, arrived, but contained duplicates of *Isselentia* only, the remaining specimens being all new species, excepting one, which proved to be the *Damayantia dilecta* of Issel, which, I believe, has not previously been found since described in 1874.

As there seems no immediate likelihood of obtaining further material, and so very little is known of the slugs of this region, the results of the examination of the

collection are now set forth, together with a list of the species of slugs which have been recorded from Borneo.

I need scarcely say how deeply indebted I am to the great kindness of Mr Ponsonby, and to the generous spirit shown by Mr R. Shelford and the authorities of the Sarawak Museum. My thanks are also tendered to Mr Edgar A. Smith, of the British Museum, for the many facilities he has given me for examining specimens in the collections under his charge. Finally, I wish to express my thanks to the Council of the Birmingham Natural History and Philosophical Society for defraying the expenses connected with the drawing of the accompanying figures.

II. The Bornean Slug-fauna.

It seems surprising that the Slug-fauna of Borneo has hitherto received so little attention. An island known to possess so rich a molluscan fauna, so far as the shelled forms are concerned, could not fail, one would think, to exhibit a wealth and variety of slug-like species. It does not, however, of necessity follow that the one always accompanies the other, at least so far as our present knowledge goes; but this possibly may be due to the fact that very little serious collecting has been undertaken for those forms in which the shell is either absent or inconspicuous. As a case in point, I may instance the Indian and Chinese faunas. In the former region a very rich fauna of land-molluscs had been described long before any number of slugs were known. Up to the present time upwards of forty species are known, and I have collections in my possession, awaiting investigation, in which there are at least another eight or nine new species. An equally rich fauna of land-molluscs is found in China, but up to the present only about a dozen species of slugs are known from that region.

One would presuppose, from the natural conditions of this island, that very many slug-like genera would be preesnt, and more careful investigation in Sarawak and the remainder of the island will, I am inclined to think, reveal a series of such of unusual interest.

Issel (6), in 1874, in his well-known work, recorded six species, viz. :—

Veronicella hasselti, v. Marts.	*Parmarion becarii*, Issel.
Veronicella bleekeri, Kerfst.	*Parmarion doriæ*, Issel.
Veronicella wallacei, Issel.	*Damayantia dilecta*, Issel.

It is open to question if the two species placed in the genus *Parmarion* are rightly assigned. Cockerell (1) has placed the *P. becarii* in the genus *Ibycus*, Heynemann, with the *P. doriæ* as a variety. From Issel's figures (6, T. iv. figs. 7–11), I am inclined to think that they both belong to the genus *Wiegmannia*. Nothing, however, being known of the internal structure of these forms, it is exceedingly difficult to say, with any certainty, what they are. Possibly the genus *Parmarion*, *sens. str.*, does not occur in Borneo; certainly nothing yet has been described from this region which

agrees with the genus as known from Java. If this view should ultimately prove to be correct, then the Bornean slug-fauna would show a closer agreement with that of the Philippines, rather than with that of Java.

Damayantia is another genus peculiar to Borneo. Hitherto it has been known only from Issel's description; it is now for the first time re-described, with some account of the anatomy and an emended description of *D. dilecta*, Issel. In the form of the mantle this genus undoubtedly shows affinities with the genera *Philippinella*, Mlldff. (8), and *Parmunculus*, Cllge. (2).

In 1895 (3), in conjunction with Lieut.-Col. H. H. Godwin-Austen, I described a new species of *Damayantia* from Borneo, and two new species of *Microparmarion*, Simr. All three, however, were generically wrongly assigned. For the latter two Simroth (13) has constituted a new genus, *Collingea*, and in this the former must now be placed. In the same year Schepmann (10) described two new species—*Parmarion goedhuisi* and *Microparmarion litteratus*. Unfortunately no particulars of their internal structure were given, so that it is difficult to say if they are generically rightly named.

Wiegmann (14), in 1898, described two further species—*Parmarion maculosus* and *P.? dubius*. This latter I have in the present paper included in the new genus *Wiegmannia*. The former is perhaps the only species which approaches in its structure the true Parmarions, though it may possibly prove to be more nearly related to *Wiegmannia*.

The remaining species all belong to the genus *Veronicella*, excepting one, the *Oncidium nigrum* of Plate (9).

III. The Genus Damayantia, Issel.

This genus was founded by Issel in 1874 (6) upon three specimens which he named *D. dilecta*. Accompanying the description, three excellent figures of the external features are given, but no account of the internal structure; and as there is only one specimen in the present collection, I am, as yet, unable to supply this very desirable information. A new species, *D. carinata*, is now described, and I am able to give some details of its internal structure.

Issel's original description* is incomplete, and in some points incorrect; while some of the characters set forth are undoubtedly due to the contraction produced by the alcohol. His three specimens measured respectively 24, 17·5, and 10·5 millim. in length. The specimen I have examined was 28 millim. long. All the *D. carinata* were about 25 millim.†

* For comparison Issel's description is here reprinted. "Mollusco terrestre privo di conchiglia e di limacella Mantello convertito in sacco viscerale e collocato alla parte anteriore del corpo. Apertura respiratoria situata a destra del mantello ed un po' all' innanzi. Orifizio genitale posto al lato destro del corpo. Testa munita di 4 tentacoli. Muso claviforme. Bocca sprovvista (?) di mandibola. Codo fornita di poro muccoso."

† For a very careful translation of those parts of Issel's work relating to the Slugs of Borneo, I am indebted to my colleague, Professor C. Bèvenot.

Damayantia, Issel (em. Cllge.).

Damayantia, Issel: *Moll. Born.*, 1874, p. 389.

Animal limaciform, long and tapering posteriorly, dorsum sharply keeled and definitely marked off from the posterior portion of the body; anteriorly the dorsum is marked with two lateral grooves. Mantle, which completely covers the shell, exhibits a well-defined right and left keel, the right one overlapping the left posteriorly. Tentacles four. Visceral mass situated anteriorly, and lying more to the right side than the left. Rugæ somewhat rhomboidal in shape, absent in the region of the mantle. Peripodial groove well defined. An obliquely placed, oval caudal mucous pore present. Generative orifice on the right side, slightly below and behind the right lower tentacle. Respiratory orifice on the right side of the mantle. Foot-fringe well marked. Foot-sole not divisible into median and lateral planes. Shell very small, almost entirely membranaceous. Receptaculum seminis sessile. Dart with solid calcareous head, at the base of which is a small opening.

Damayantia is undoubtedly related to the genus *Philippinella* of Möllendorff (8).

1. *Damayantia dilecta*, Issel.

Damayantia dilecta, Issel: *Moll. Born.*, 1874, p. 390, T. iv. figs. 4–6.

Pl. I. figs. 1–3.

Animal yellowish-brown. Mantle completely covers the shell, minutely spotted with black. Keels well developed on the postero-lateral portions of the visceral mass and overlap one another posteriorly on the median line. The dorsum is sharply keeled. Rugæ small anteriorly, postero-laterally large and somewhat rhomboidal, absent on mantle. Caudal mucous pore large and overlapped by the extremity of the tail. Peripodial groove well defined. Foot-fringe yellowish in the anterior region, brownish posteriorly; lineoles faint and set very closely. Foot-sole white, narrow, divided into median and lateral planes.

Length (in alcohol) 28 millim.

Hab.—Mt. Penrissen, 2800–3500 feet. 1 specimen.

Issel (6, p. 28) mentions the presence of two longitudinal and medial furrows on the top part of the head, and at the sides two polygonous tubercles. In the specimen examined these features were not discernible.

2. *Damayantia carinata*, n. sp.

Pl. I. figs. 4, 5; Pl. II. figs. 22, 23.

Animal greyish-brown, postero-laterally a faint dark band runs from the posterior end of the visceral mass to the tail; lateral grooves well defined. Mantle completely

covers the shell; posteriorly the two keels meet on the visceral mass, the right overlapping the left one. Posteriorly the body is sharply keeled, the keel being broken at irregular intervals, giving it a jagged or toothed appearance. Rugæ small and indistinct, excepting on the postero-lateral portion, where they stand out conspicuously. Caudal mucous pore small. Peripodial groove distinct. Foot-fringe same colour as body with very faint, closely set, sepia-coloured lineoles. Foot-sole almost white, narrow.

Length (in alcohol) 25·5 millim.

Shell membranaceous, thin, almost transparent, slight indication of apical whorl; striæ faint; ventrally there is a thin calcareous portion toward the apex.

Maj. diam. 6·8 ; min. diam. 5·5 millim., about.

Hab.—Kuching, Mt. Penrissen, and Mt. Santubong, N.W. Borneo.

Generative Organs.—(Pl. II. figs. 22, 23.)

The male organ opens into the vestibule as a narrow tube, just beyond which it becomes enlarged and forms an ovoid sac, giving place again to a short tube-like portion which distally again becomes sac-like. At the distal end there is a short diverticulum. The retractor muscle is inserted on the right side at the distal end, almost opposite to which the short vas deferens connects the prostatic canal with the penis. The receptaculum seminis is a simple, pear-shaped, sessile sac, covered in life by the bend of the large dart-gland. There is a well-developed vagina; the free oviduct is extremely short. The common duct is richly folded. The dart-gland is very large and has a sharp **S**-shaped bend at about the middle of its length; distally there is a short retractor muscle. The dart (Pl. II. fig. 23) is a hollow tube with a solid calcareous head; at the base of the head is a small lateral opening.

IV. The Genus Wiegmannia, n. gen.

As already pointed out, Wiegmann in 1898 described a slug-like mollusc from Borneo, to which he gave the name *Parmarion ? dubius*. In the present collection there are four specimens which must be classed in the same genus as *P. ? dubius*. From the external characters and the internal structure, it is clear that they cannot be placed in the genus *Parmarion*, Fisch., or *Microparmarion*, Simr. I therefore propose a new genus for their reception, and have much pleasure in associating with it the name of Herrn Fritz Wiegmann of Jena, whose anatomical studies have so largely added to our knowledge of the mollusca of the Malayan Archipelago.

In connection with Wiegmann's work (14), I may perhaps be permitted to point out that the *Parmarion flavescens* of Keferstein is not a *Parmarion* at all, but a true *Urocyclus* (7); further, that the *Parmarion extranea*, Fer., undoubtedly belongs to the genus *Girasia, sens. str.*, agreeing, as it does, with the Indian forms, although it is extremely doubtful if the species figured by Semper is the *extranea* of Ferussac (*cf.* Godwin-Austen, 4, pp. 217–218). Semper imagined that the structure of

Urocyclus flavescens, Kerfst., agreed pretty well with that of *Parmarion pupillaris*, Humb., and *Girasia extranea*, Fer. : but I am not of this opinion (*cf.* Semper, *Reis. Arch. Philip.*, p. 11). The literature relating to the Asiatic and Malayan slugs and slug-like molluscs abounds in similar inaccuracies. The two forms (*Urocyclus flavescens*, Kerfst., and *Parmarion pupillaris*, Humb.) are widely separated from one another, externally, anatomically, and geographically.

Wiegmannia, n. gen.

Animal Parmarion-like. Anteriorly the dorsum is marked with two lateral grooves, which, commencing from the sides of the head, converge towards the median line, and then pass to the right and left respectively. There is also a conspicuous row of rugæ passing between these two lateral grooves in the mid dorsal line. Posteriorly the dorsum is keeled. The mantle shows faint traces of a keel, and has a thin shell border more or less covering the borders of the shell. Visceral mass large and lying upon a depression of the dorsum. Generative orifice immediately behind and below the right lower tentacle. Tail truncate, with large slit-like mucous pore which extends to the foot-sole. Dart-gland and sac large ; dart with solid calcareous tip. Penis has a small diverticulum. Receptaculum seminis sessile.

Shell a thin membranaceous sac, covering the posterior border of the visceral mass.

1. *Wiegmannia dubius*, Wgm.

Parmarion ? dubius, Wgm. : *Abhandl. d. Senck. naturf. Gesell.*, 1898, Bd. ii. p. 105, T. xxi. figs. 27–40 ; T. xxii. figs. 1–6.

For purposes of comparison, I have reproduced Wiegmann's figures of the external portion of the head and parts of the generative organs (Pl. II. figs. 24–26), from which, I think, it will at once be evident that this species belongs to the same genus as the following specimens.

One point to be noted is that Wiegmann failed to find in either of his specimens any dart. He writes (14, p. 298) : "Während nämlich die weibliche Anhangsdrüse bei der Species von Java, ebenso wie bei *P. pupillaris* nach Semper, nut einem Kalkigen Pfeile von sehr charakteristischen Form versehen ist, fehlt dieser gänzlich den beiden vorliegenden Tieren von Borneo, bei welchen die Pfeildrüse in einen durchbohrten fleischigen Papille endigt." Judging from the figure of this fleshy papilla (14, Taf. xxi. fig. 40, and reproduced here on Pl. II. fig. 26), it has all the characters of a fundus, showing a dart in course of formation.

2. *Wiegmannia gigas*, n. sp.

Pl. I. figs. 6–8 ; Pl. II. figs. 27, 28.

Animal greyish-brown, with few blackish blotches on the sides of the body posteriorly. Head and tentacles dark blue, lateral grooves prominent, median line

of rugæ well marked. Mantle finely spotted with black; posteriorly does not cover the visceral mass; has a thin shell-border and faint trace of a keel. Extremity of foot truncate. Posterior portion of dorsum bluntly keeled. Rugæ ill defined, fairly large laterally. Sulci blackish. Caudal mucous pore a longitudinal vertical slit extending to the foot-sole. Peripodial groove distinct. Foot-fringe same colour as the body with faint black lineoles. Foot-sole yellowish-brown, with two faint chocolate-coloured bands between median and lateral planes; lateral planes marked by transverse lines, median plane papillated.

Length (in alcohol) 50 millim., foot-sole 10 millim. Shell dark amber-coloured, membranaceous, faint trace of apical whorl.

Hab.—Kuching, N.W. Borneo.

This fine species is the largest I have seen of the genus. The visceral mass is considerably larger than in either of the two following species, and the keel on the mantle is only very feebly developed.

Generative Organs.—(Pl. II. figs. 27, 28.)

The vestibule is a large, spacious cavity, into which the penis opens on the right side. This latter organ is very characteristic of the genus, differing in its length, peculiar form, and the presence of a diverticulum, from the same organ in *Parmarion* and *Microparmarion*. In the present species it is folded upon itself at a distance of about one-third from its proximal end; then forming a loop-like portion it enters the distal third; at the distal end of the loop-like portion, a short retractor muscle is inserted, and at the commencement of the distal third there is a short diverticulum. I looked carefully for any trace of calcareous granules here, but did not succeed in finding any. Gradually tapering to a fine tube, the penis now passes imperceptibly into the long vas deferens, which joins the prostatic portion of the common duct on its left side (Pl. II. fig. 27). The receptaculum seminis is a large, pear-shaped, sessile sac, and has, in this species, a short retractor muscle attached to its free end (Pl. II. fig. 27). The vagina is a short tubular cavity with the small opening of the receptaculum seminis on the right side—when looked at from the anterior end—and the larger opening of the free-oviduct on the left. This latter organ is rather more than three times the length of the vagina; it is coiled upon itself, making a single turn, and then passes into the larger, richly convoluted oviducal portion of the common duct, which is also folded upon itself toward the anterior end. A similar condition obtains in all the three new species here described. The albumen gland is large, as is also the flattened, elongated hermaphrodite gland, which latter has a comparatively short and slightly convoluted duct. The dart-gland is a large and conspicuous organ, lying on the left ventral side. It has the usual fold at about its middle, and a short retractor muscle at its distal end (Pl. II. fig. 27). The dart is smaller than in either of the two following species; it measures 3·7 millim. in length, is slightly curved, and the body, externally, is not differentiated from the head, which is a solid calcareous tip.

3. *Wiegmannia ponsonbyi*, n. sp.

Pl. I. figs. 9, 10; Pl. II. figs. 29, 30.

Animal yellowish-brown, with few, almost black, blotches and spots. Head almost black; lateral grooves and median line of rugæ well marked. Mantle same colour as body, comes upon all sides of the visceral mass, and has a thin shell-border and fairly well-developed keel. Extremity of foot truncate. Posterior portion of dorsum bluntly keeled. Rugæ faintly marked. Sulci blackish. Caudal mucous pore a longitudinal vertical slit extending to the foot-sole. Peripodial groove prominent. Foot-fringe same colour as the body; lineoles black. Foot-sole almost black anteriorly, posteriorly same colour as the body; divided into median and lateral planes.

Length (in alcohol) 42 millim.

Shell same as in *W. gigas*, only smaller and reddish-brown in colour.

Hab.—Kuching, N.W. Borneo.

Generative Organs.—(Pl. II. figs. 29, 30.)

The external form of the penis differs considerably from that of *W. gigas* or *W. dubius*, Wgm.; it is much shorter and is not folded to anything like the same extent. From the vestibule as far as the diverticulum it is uniform in circumference; opposite the diverticulum there is a small retractor muscle inserted. The distal portion of the penis gradually tapers, giving place to the vas deferens (Pl. II. fig. 29). The receptaculum seminis is small, somewhat pear-shaped, and opens into the right side of the vagina. This latter organ is much longer than in the preceding species and exhibits a slight constriction just beyond its anterior third. The free-oviduct, on the other hand, is very short. The dart-gland is similar to that in *W. gigas*, only larger and not so uniform in shape, exhibiting a series of constrictions and dilatations in the anterior (Pl. II. fig. 29, *d.s.*). Structurally the dart is the same as that in *W. gigas*, but in this species the one present was much more fragile, and a little over twice the length of that found in the preceding species (Pl. II. fig. 30).

4. *Wiegmannia borneensis*, n. sp.

Pl. I. figs. 11, 12; Pl. II. figs. 31, 32.

Animal brownish-yellow with faint blackish mottling on the fore part of the head and dorsum, lateral grooves and median line of rugæ well marked. Mantle same colour as body with dark mottling; comes upon all sides of the visceral mass; has a thin shell-border; keel more conspicuous posteriorly. Extremity of foot truncate. Posterior portion of dorsum keeled. Rugæ large. Sulci sepia coloured. Caudal mucous pore a vertical slit extending to the foot-sole. Peripodial groove

distinct. Foot-fringe same colour as the body, with faintly coloured lineoles. Foot-sole brownish-yellow with median and lateral planes.

Length (in alcohol) 49 millim.

Shell a thin membranaceous sac, reddish-brown in colour, with very faint lines of growth; apical portion distinct.

Hab.—Kuching, N.W. Borneo.

Generative Organs.—(Pl. II. figs. 31, 32.)

The generative organs agree more closely with those of *W. gigas* than with those of *W. ponsonbyi*. The vestibule is sac-like, and the vagina long, as in *W. ponsonbyi*. The penis is folded upon itself at a distance of about one-third from its proximal end; this and the middle portion form a fairly wide tube, which now gradually tapers until it passes into the vas deferens. At the point where the retractor muscle is inserted (Pl. II. fig. 31, *div.*) there is a small diverticulum. The receptaculum seminis is a somewhat ovoid-shaped sac opening on the right side of the vagina. The free-oviduct is proportionally not so long as in *W. gigas*, but longer than in *W. ponsonbyi*. The dart-gland is very similar in shape to that in *W. gigas*, but the dart-sac contained a dart more like that described for *W. ponsonbyi*, differing, however, in possessing a more perfectly developed head, with a longer, solid, calcareous tip (Pl. II. fig. 32).

5. *Wiegmannia*, sp.

A small, bluish-grey form, measuring 14 millim. in length (in alcohol); may possibly be a further new species. The mantle border is finely spotted, and posteriorly it rises around the visceral mass, and has a well-developed keel encircling it. I await further material before naming the specimen.

Hab.—Mt. Penrissen, 2800–3500 feet.

V. The Genus Collingea, Simr.

Collingea, Simr.: *Zool. Jahrb.* (*Abth. f. Syst.*), 1898, Bd. ii. p. 168.

In 1895 (3), I described, in conjunction with Lieut.-Col. H. H. Godwin-Austen, a slug-like mollusc from the Poeh Mountains, Sarawak, to which the name *Damayantia smithi* was given. At that time I had not seen Issel's description (6) and figures of *D. dilecta*; but Lieut.-Col. Godwin-Austen was of opinion that the specimens from the Poeh Mountains belonged to Issel's genus. Having recently seen a specimen of *D. dilecta* and compared it with Issel's description and figures, I have no hesitation in at once removing the specimen named *D. smithi* from that genus.

Through the kindness of Mr Edgar A. Smith, I have had the opportunity of re-examining this very interesting mollusc, and am now able to give an emended description of it and some further particulars respecting its internal structure.

Unfortunately, a very serious error was made at the time it was originally described.

Mr Edgar A. Smith sent me three specimens. One of these Godwin-Austen figured (3, pl. xi. figs. 1–6), which undoubtedly belongs to the genus *Collingea*, Simr. One of the remaining two I dissected, and described and figured the generative organs (*cf.* 3, pl. xi. figs. 9–11); but, unfortunately, this was very distinct from the one which Godwin-Austen figured, and on re-examining it I find that it and its fellow belong to the genus *Isselentia* here described (p. 305).

The specimen of *Collingea smithi* had been opened, and I have made a careful examination of the generative organs, and figures of these are now given for the first time (Pl. II. figs. 34–36). The peculiar handle-like extension of the penis (the Henkel of Simroth) at once characterises this species as belonging to the genus *Collingea*.

Godwin-Austen has given (5, pp. 55–57) what he terms an amended description of both the animal and anatomy of what was originally termed *Damayantia smithi*. The description of the animal, of course, applies to *Collingea smithi*, whilst the anatomical account applies, in so far as it is correct, to *Isselentia globosa* (p. 305). It is doubtful if Godwin-Austen refers to a true *Damayantia*, especially as he compares these two molluscs with *D. dilecta*. Issel's figures (6, T. iv. figs. 4–6) show how different the genus is from *C. smithi* or *I. globosa*.

This author, on p. 58, writes: "I illustrate the anatomy of *Microparmarion* with my original drawings (*those in the* P. Z. S., *1895, being copies of them**)." The figures in the *P. Z. S.* paper, which are credited to me, were made by me from the dissections.

1. *Collingea smithi*, Cllge. and Godw.-Aust.

Pl. II. figs. 33–36.

Damayantia smithi, Cllge. and Godw.-Aust.: *Proc. Zool. Soc.*, 1895, p. 242, pl. xi. figs. 1–4.
Damayantia smithi, Godwin-Austen: *Moll. of India*, 1898, vol. ii. p. 55, pl. lxxiii. figs. 1–7*d*.

Animal: body yellowish, with dark blue or bluish-brown mottling on the sides in the posterior region.† Mantle yellowish-grey with irregular dark blue or black mottling; has a thin shell-border and distinct lateral keel. Extremity of foot truncate. Posterior portion of dorsum sharply keeled. Rugæ large. Caudal mucous pore large, but does not extend to the foot-sole. Peripodial groove well marked. Foot-fringe yellowish-brown with faintly marked lineoles. Foot-sole darker than the foot-fringe and divided into median and lateral planes.

Length (in alcohol) 28 millim.; breadth of foot-sole 4·5 millim.

Shell oval, membranaceous, thin, and shiny; apical whorl distinct (Pl. II. fig. 33).

Hab.—Poeh Mountain (3500 feet), Sarawak (A. H. Everett).

Type in collection of British Museum.

Generative Organs.—(Pl. II. figs. 34–36.)

The vagina is a wide, sac-like cavity, on the left side of which the receptaculum

* The italics are mine.—W. E. C.

† Originally described as a "very dark blue or black streak runs along the side of the foot posteriorly, crossing it diagonally downwards to the mucous pore." The figure is wrong in showing this.

seminis opens. This is an irregular-shaped sac with a short duct. The penis is a thick, muscular-walled tube, narrow at its proximal end, but increasing in size as it nears the distal end, where it makes a sharp bend to the right, this distal extremity forming a sac-like extension (Pl. II. fig. 34, 35). On the left-hand side is a loop-like extension—the Henkel of Simroth. The vas deferens leaves the distal extremity of the penis on its ventral side (Pl. II. fig. 36, *v.d.*). The retractor muscle also is inserted on the ventral side, at the point where the penis makes a sharp bend to the right, (Pl. II. fig. 36, *r.m.*). The dart-gland (Pl. II. fig. 34, *d.gl.*) is a large, muscular organ; distally it presents a swollen appearance which occupies about one-half; the proximal half is tube-like.

Compared with the three known species of *Collingea*, viz., *C. strubelli*, Simr., *C. pollonerai*, Cllge. and Godw.-Aust., and *C. simrothi*, Cllge. and Godw.-Aust., this species approaches most nearly to *C. simrothi*. It differs considerably from *C. strubelli* (12) in the form of the penis and dart-gland, and in the same manner from *C. pollonerai*.

VI. The Genus Isselentia, n. gen.

Animal slug-like. The mantle anteriorly forms two wing-like appendages lying on each side of the visceral mass, inner borders plicated or folded, comes up around the posterior and lateral borders of the visceral mass; shell-borders thin. Dorsum posteriorly keeled. Generative orifice behind right lower tentacle. Small caudal mucous pore. Foot-sole divided into median and lateral planes. Viscera elevated into the dorsal hump, the body-cavity not extending beyond it into the tail, which is solid.

Generative system: penis with or without diverticulum. Sessile receptaculum seminis. Dart calcareous, with small laterally placed aperture.

1. *Isselentia plicata*, n. sp.

Pl. II. figs. 13–15*b*; Pl. III. figs. 37–49.

Animal yellowish with dark blue dorsum posteriorly, head bluish. Mantle reddish-yellow, with small blackish spots and blotches; shell-border thin. Posterior portion of dorsum exhibits a wavy keel of a deep yellow colour. Rugæ more or less ovoid. Caudal mucous pore small and partly hidden by the extremity of the dorsum. Peripodial groove very prominent. Foot-fringe yellow, with fine, very closely set lineoles. Foot-sole yellowish, divided into median and lateral planes.

Length (in alcohol) 26 millim.

Shell amber-coloured; a thin membranaceous sac; apical whorl distinct.

Hab.—Mt. Penrissen and Mt. Santubong.

Generative Organs.—(Pl. III. figs. 37–49.)

The penis is of considerable length; it has a somewhat globose proximal portion, followed by a narrower portion, again expanding and narrowing, and terminating by a

sharp bend, gives place to a somewhat conical head. The whole of the distal end is covered with connective tissue, so that at first sight it has the appearance shown in fig. 37 (Pl. III.). When, however, this is dissected away, the S-shaped bend is seen, the tube becoming gradually larger as it nears the point where the retractor muscle is inserted (Pl. III. fig. 38). The external wall exhibits a series of ring-like constrictions; one of these immediately beyond the retractor muscle is much deeper and sharply divides the "head" into two parts, viz., that already described and the conical portion beyond, which has similar constrictions. This gradually tapers off into the vas deferens (Pl. III. fig. 37). The vagina is a long, wide tube, having an opening on its dorsal wall for the small, twisted receptaculum seminis, and a larger opening at its posterior end for the small globular free-oviduct. The first portion of the common duct is sharply coiled upon itself. The dart-gland (Pl. III. fig. 37, *d.gl.*) when viewed externally exhibits a globose distal portion, to which a small retractor muscle is attached, a middle tube-like portion, forming the bend, and a dart-sac, the proximal portion. Three specimens were examined. In the first the dart was immature, and had the peculiar bent form shown in fig. 40 (Pl. III.). In the second specimen this was in much the same condition. In the third, however, a well-formed dart was present, measuring 4 millim. in length. The dart is situated at the posterior end of the proximal sac-like portion. Externally the dart is covered by a calcareous sheath, which has a small, laterally placed, oval-shaped aperture. The head is not differentiated from the body, which is almost straight and about the same thickness throughout (Pl. III. figs. 39–42).

Under a high power of the microscope, the calcareous layer is seen to consist of an outer structureless layer, and an inner one which, when looked at longitudinally, has the appearance of short dark and light bands (Pl. III. fig. 41). This inner layer is more conspicuous in the region of the head than elsewhere. The basal end or annulus (Pl. III. fig. 43) fits into a groove; and so far as I could make out the structure, which proved very difficult, the internal cavity of the dart is continuous with that of the expanded distal portion of the dart-gland (Pl. III. fig. 44).

The dart-gland consists of a thin external sheath of connective tissue, within which is a longitudinal muscular layer, and then a layer of circular muscle fibres with a few radial fibres intermixed, some of these latter extending as far as, and into, the longitudinal layer. The central cavity is bounded by an epithelial lining (Pl. III. figs. 45 and 47). Longitudinal and transverse sections were made of both the proximal and distal portions. The former has a glandular lining, and when looked at in surface view, the wall has the appearance of being studded with a series of bluntly pointed papillæ (Pl. III. fig. 49). In longitudinal section these are seen to consist of an outer epithelial layer of cuboid cells, and an inner layer of almost circular cells (Pl. III. figs. 46 and 48). In the distal portion the epithelial lining consists of columnar cells, and the cavity contains a larger series of exceedingly minute particles (calcareous?) imbedded in a jelly-like matrix. Sections cut by a freezing microtome were stained in an aqueous solution of magenta, but the matrix remained unstained. Others were treated with

5 and 10 per cent. solutions of hydrochloric acid, but no effect was obtained. Strong hydrochloric acid caused the matrix to coagulate.

2. *Isselentia globosa*, n. sp.

Pl. III. fig. 50.

Animal smaller but not at all unlike *I. plicata*; the ground colour, however, is lighter, and the posterior portions of the dorsum considerably lighter. The plications of the mantle lobes are only slightly developed.

Hab.—Poeh Mountain (3500 feet), Sarawak (A. H. Everett).

Type in collection of British Museum. Two specimens.

When recently examining these two specimens, I felt inclined to refer them to *I. plicata*, but an examination of the generative organs shows that they exhibit some important differences.

Generative Organs.—(Pl. III. fig. 50.)

The vestibule is small. The penis consists of a sac-like portion, above which it becomes suddenly constricted and then dilates into a bulbous head. From the distal portion of the penis, above the vas deferens, is a short diverticulum, partially covered by the strong retractor muscle (Pl. III. fig. 50). From the side of the bulbous head of the penis the vas deferens passes off as a thick tube, narrowing gradually as it approaches the prostatic portion of the common duct. The receptaculum seminis is somewhat ovoid and sessile, and opens into the vagina; to the right of this is the opening of the free-oviduct. The first portion of this organ is thrown into a series of constrictions. The oviduct is a wide tube and densely folded, the prostatic and oviducal portions terminating in a bulbous head lying immediately in front of the globular albumen gland. The hermaphrodite gland is almost circular and flattened, showing a slight fold or indentation in the centre. The dart-gland is a large, thick, muscular-walled tube, making a sharp **S**-shaped bend distally. Just below this is the dart-sac, which contains a calcareous dart similar in shape to that in *I. plicata* (Pl. III. fig. 39), but whether or not it is perforated I cannot say, as the head had been broken away.

VII. The Genus Veronicella, Blainv.

1. *Veronicella shelfordiana*, n. sp.

Pl. I. figs. 16, 17.

Animal dark-brown dorsally, with dense yellow spotting and median dorsal yellowish-brown stripe. Hyponotum and foot-sole light-brown.

Length (in alcohol) 20 millim.; foot-sole 2·5 millim. broad; hyponotum 4 millim. broad. Female generative orifice on the right side, 3 millim. from the foot-sole, 11·5

millim. from the right lower tentacle, and 8·5 millim. from the posterior end of the body.

Hab.—Kuching, N.W. Borneo.

I have pleasure in associating with this handsome species the name of Mr Shelford of the Sarawak Museum.

2. *Veronicella exima*, n. sp.

Pl. I. figs. 18, 19.

Animal yellowish-brown dorsally, densely and minutely speckled with black, leaving a clear unicolourous margin and broad medio-dorsal line. Hyponotum yellowish-brown; foot-sole brown.

Length (in alcohol) 22·5 millim.; foot-sole 2 millim. broad; hyponotum 3·5 millim. broad. Female generative orifice on the right side, 3 millim. from the foot-sole, 12·5 millim. from the right lower tentacle, and 12 millim. from the posterior end of the body.

Hab.—Kuching, N.W. Borneo.

VIII. The Genus Onchidium, Buchan. (em. Plate).

1. *Onchidium ponsonbyi*, n. sp.

Pl. I. figs. 20, 21.

Animal dirty green dorsally with large, irregularly distributed black spots. Hyponotum dark greenish-blue; foot-sole dirty yellow.

Length (in alcohol) 30 millim.; hyponotum 10 millim.; foot-sole 8 millim.

Hab.—Mt. Penrissen (2800-3500 feet).

It gives me much pleasure to associate with this very fine species the name of Mr Ponsonby.

IX. Summary and Conclusion.

From an examination of the foregoing specimens it is, as yet, difficult to generalise as to their affinities or relationships with allied genera, for our knowledge of their structure and specific variation is too fragmentary. Further, it is of little use comparing the form and structure of the generative organs of such genera as *Wiegmannia* and *Isselentia* with *Parmarion*, *Microparmarion*, etc., for our knowledge of the structure of these latter genera is not much more complete. I sincerely hope, however, that with the invaluable aid of Mr Shelford and other naturalists, I shall be able, before long, to treat of the general anatomy of many of the Bornean slugs in much greater detail. The present communication must be regarded more in the light of a preliminary notice of species, which, as further material is obtained, will receive more exhaustive treatment.

X. List of Species of Slugs recorded from Borneo.

Damayantia, Issel: *Ann. Mus. Civ. Genova*, 1874, vi. p. 26.

1. *D. dilecta*, Issel: *Ibid.* p. 27, T. iv. figs. 4–6.
2. *D. carinata*, Cllge.: *Ante*, p. 298.

Wiegmannia, Cllge.: *Ante*, p. 299.

3. *W. dubius*, Wgm.: *Abhandl. d. Senckenb. naturf. Gesell.*, 1898, p. 305, T. xxi. figs. 27–40, T. xxii. fig. 1–6.
4. *W. gigas*, Cllge.: *Ante*, p. 300.
5. *W. ponsonbyi*, Cllge.: *Ante*, p. 302.
6. *W. borneensis*, Cllge.: *Ante*, p. 302.
7. *W.*, sp.: *Ante*, p. 303.

Collingea, Simr.: *Zool. Jahrb.* (*Abth. f. Syst.*), 1898, Bd. ii. p. 168.

8. *C. pollonerai*, Cllge. and Godw.-Aust.: *Proc. Zool. Soc.*, 1895, p. 244, pls. xii., xiii., figs. 13–25.
9. *C. simrothi*, Cllge. and Godw.-Aust.: *Ibid.* p. 246, pls. xii., xiii., figs. 26–35.
10. *C. smithi*, Cllge. and Godw.-Aust.: *Ibid.* p. 242.

Ibycus, Heyn.: *Mal. Blätt.*, 1862, p. 142, pl. 1, fig. 3.

11. *I. beccarii*, Issel: *Ann. Mus. Civ. Genova*, 1874, vi. p. 23, T. iv. figs. 9–11.
12. *I. doriæ*, Issel: *Ibid.* p. 25, T. iv. figs. 7, 8.

Parmarion, P. Fischer: *Actes. Soc. Linn. Bordeaux*, 1855.

13. *P. maculosus*, Wgm.: *Abhandl. d. Senckenb. naturf. Gesell*, 1898, p. 299, T. xxi. figs. 8–26.
14. *P. goedhuisi*, Schepm.: *Notes fr. Leyden Mus.*, 1895, vol. xvii. p. 146, pl. 2, figs. 1*a*–1*c*.

Microparmarion, Simr.: *Zool. Ergebnisse*, 1893, Bd. iii. p. 104.

15. *M. litteratus*, Schepm.: *Notes fr. Leyden Mus.*, 1895, vol. xvii. p. 148, pl. 2, figs. 2*a*–2*c*.

Isselentia, Cllge.: *Ante*, p. 305.

16. *I. plicata*, Cllge.: *Ante*, p. 305.
17. *I. globosa*, Cllge.: *Ante*, p. 307.

Veronicella, Blainv.: *Journ. de Physique*, 1817, p. 440, pl. vi. figs. 1, 2.

18. *V. bleekeri*, Kerfst.: *Zeit. f. wiss. Zool.*, 1865, Bd. xv. p. 125, T. ix. figs. 1–7.
19. *V. hasselti*, v. Marts.: *Die Landschnecken Preuss. Exped. nach Ost-Asien*, 1867, p. 176, T. v. figs. 2, 4.
20. *V. flava*, Heyn.: *Jahrb. Deutsch. Malad. Gessel.*, 1885, Bd. xii.
21. *V. idæ*, Semp.: *Reisen im Arch. Philip.*, 1885, Heft. vii. p. 321.
22. *V. borneensis*, Simr.: *Abhandl. d. Senckenb. naturf. Gesell.*, 1897, Bd. xxiv. p. 142, T. xiv. figs. 8, 15, 16, 17.
23. *V. wallacei*, Issel: *Ann. Mus. Civ. Genova*, 1874, vi. p. 22, T. iv. figs. 1–3.
24. *V. shelfordiana*, Cllge.: *Ante*, p. 307.
25. *V. exima*, Cllge.: *Ante*, p. 308.

Onchidium, Buchan. (em. Plate): *Trans. Linn. Soc.*, 1800, vol. v. p. 132.

26. *O. nigrum*, Plate: *Zool. Jahrb.* (*Abth. f. Morph.*), 1893, Bd. 7, p. 188, T. 8, fig. 31*a*; T. 10, fig. 53; T. 11, fig. 75.
27. *O. ponsonbyi*, Cllge.: *Ante*, p. 308.

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XII. Reference Letters.

alb.gl. Albumen gland.
ap. Aperture of dart.
c.d. Cavity of dart.
c.d.gl. Cavity of dart-gland.
c.e. Columnar epithelium.
c.t. Connective tissue.
c.m. Circular muscle fibres.
d. Dart.
d.gl. Dart-gland.
d.s. Dart sac.
div. Diverticulum of penis.
ep. Epithelium.
f.ov. Free-oviduct.
gl. Gland cells.
H. Henkel.
h.d. Hermaphrodite duct.
h.gl. Hermaphrodite gland.
i.c.l. Inner calcareous layer.
l.m. Longitudinal muscle fibres.
l.p. Lateral plane of foot-sole.
m.p. Median plane of foot-sole.
o.c.l. Outer calcareous layer.
ov. Oviduct.
p. Penis.
pr. Prostate.
r.m. Retractor muscle.
r.m.f. Radial muscle fibres.
r.s. Receptaculum seminis.
v. Vestibule.
v.d. Vas deferens.
vg. Vagina.

XIII. Description of Plates.

Plate I.

Fig. 1. *Damayantia dilecta*, Issel. Lateral view, × 2.
Fig. 2. ,, ,, ,, Dorsal view, × 2.
Fig. 3. ,, ,, ,, Dorsal view of shell, × 1½.
Fig. 4. *Damayantia carinata*, n. sp. Lateral view, × 2.
Fig. 5. ,, ,, Dorsal view, × 2.
Fig. 6. *Wiegmannia gigas*, n.sp. Lateral view, × 1.
Fig. 7. ,, ,, Dorsal view of the head, showing lateral grooves and median row of rugæ, × 2.
Fig. 8. ,, ,, Foot-sole showing median and lateral planes, × 3.
Fig. 9. *Wiegmannia ponsonbyi*, n. sp. Lateral view, × 1.
Fig. 10. ,, ,, Dorsal view of the head, × 2.
Fig. 11. *Wiegmannia borneensis*, n. sp. Lateral view, × 1.
Fig. 12. ,, ,, Dorsal view of the head, × 2.
Fig. 13. *Isselentia plicata*, n. sp. View from the right side, × 2.
Fig. 14. ,, ,, View from the left side, × 2.
Fig. 15. ,, ,, Dorsal view, × 2.
Figs. 15*a*, *b*. ,, ,, Dorsal and ventral view of shell, × 1.
Fig. 16. *Veronicella shelfordiana*, n. sp., as seen from above, × 2.
Fig. 17. ,, ,, as seen from below, × 2.
Fig. 18. *Veronicella exima*, n. sp., as seen from above, × 2.
Fig. 19. ,, ,, as seen from below, × 2.
Fig. 20. *Onchidium ponsonbyi*, n. sp., as seen from above, × 1.
Fig. 21. ,, ,, as seen from below, × 1.

Plate II.

Fig. 22. *Damayantia carinata*, n. sp. Generative organs.
Fig. 23. ,, ,, Dart, × 16.
Fig. 24. } *Wiegmannia dubius*, Wgm. Parts of the terminal ducts of the generative organs (after Wiegmann).
Fig. 25. }
Fig. 26. ,, ,, Dart (after Wiegmann).
Fig. 27. *Wiegmannia gigas*, n. sp. Generative organs.
Fig. 28. ,, ,, Dart, × 16.
Fig. 29. *Wiegmannia ponsonbyi*, n. sp. Generative organs.
Fig. 30. ,, ,, Dart, × 16.
Fig. 31. *Wiegmannia borneensis*, n. sp. Generative organs.
Fig. 32. ,, ,, Dart, × 18.
Fig. 33. *Collingea smithi*, Cllge. and Godw.-Aust. Shell, × 2·5.
Fig. 34. ,, ,, ,, Generative organs.
Fig. 35. ,, ,, ,, Dorsal view of penis, etc.
Fig. 36. ,, ,, ,, Ventral view of penis, etc.

Plate III.

Fig. 37.	*Isselentia plicata*, n. sp.	Generative organs.
Fig. 38.	,, ,,	Distal end of penis, enlarged.
Fig. 39.	,, ,,	Dart, × 15.
Fig. 40.	,, ,,	Immature dart.
Fig. 41.	,, ,,	Head of dart, highly magnified.
Fig. 42.	,, ,,	Portion of immature dart, showing bends in calcareous sheath.
Fig. 43.	,, ,,	Diagrammatic view of fundus.
Fig. 44.	,, ,,	Distal end of dart-gland showing cavity.
Fig. 45.	,, ,,	Diagrammatic view of a transverse section through the distal portion of the dart-gland.
Fig. 46.	,, ,,	Longitudinal section through the proximal portion of the dart-gland.
Fig. 47.	,, ,,	Transverse section through the distal portion of the dart-gland.
Fig. 48.	,, ,,	Epithelial and gland cells from the proximal portion of the dart-gland.
Fig. 49.	,, ,,	Surface view of the internal wall of the dart-gland, proximal portion.
Fig. 50.	*Isselentia globosa*, n. sp.	Generative organs.